

concrete piles. For each size of steel pile listed in the bid schedule, the price bid for furnishing may not exceed 70% of the combined price bid for furnishing and driving.

Payment for driving piles includes full compensation for all costs involved in the actual driving and cutting off piles and pile shells, and for all costs for which compensation is not provided for under other pay items involved with the furnishing of labor, equipment, and materials used to construct the piles as shown in the contract documents.

Payment for load tests includes full compensation for providing labor, equipment, and materials needed to perform the load tests as specified.

Payment for metal pile shoes includes full compensation for all costs involved with furnishing all materials and performing the work involved with installing metal pile shoes.

SECTION 515

PENETRATING WATER REPELLENT TREATMENT

515.01. DESCRIPTION.

This work consists of furnishing necessary labor, materials, and equipment to treat concrete surfaces with a penetrating water repellent treatment solution according to the contract documents.

515.02. MATERIALS.

Penetrating water repellent treatment solution shall meet the requirements of Subsection 701.12.

515.03. EQUIPMENT.

- (a) **General.** Furnish equipment meeting the requirements of Subsection 108.06 and the treatment solution manufacturer's recommendations.
- (b) **Surface Preparation.** Use one or more of the following types of equipment for surface preparation.
 - 1. *Sand Blasting.* A compressed air pressure type sand blasting equipment of proper size and capacity to clean concrete surfaces as specified.
 - 2. *Shot Blasting.* A portable type machine designed especially for cleaning horizontal concrete surfaces utilizing recyclable steel shot blast techniques.
 - 3. *Hot Water Pressure Washers.* A hot water pressure system for cleaning concrete surfaces as specified, utilizing 160°F (70°C) minimum water temperature at 2500 psi (17 MPa) nozzle pressure.
 - 4. *Hydroblast Washer.* A high pressure cold water washer unit for cleaning concrete surfaces as specified, using 7000 psi (48 MPa) nozzle pressures.
 - 5. *Steam Cleaning.* A steam jet cleaning equipment for preparing concrete surfaces as specified, utilizing 320°F (160°C) water temperature under 300 psi (2 MPa) operating pressure.

- (c) **Application.** Use low pressure airless type spray equipment with 15 psi (100 kPa) to 40 psi (275 kPa) application pressure.

515.04. CONSTRUCTION METHODS.

(a) **Treatment.**

1. *General.* Employ personnel certified by the treatment solution manufacturer to clean the concrete surface and apply the penetrating water repellent solution. Follow the manufacturer's explicit procedures for surface preparation and application. Before starting work, provide the Engineer with the following information:
 - The identification of the treatment solution to be used by brand name, the name of the manufacturer and a copy of the manufacturer's unabridged application procedures;
 - A description of the surface preparation methods and equipment to be used;
 - A description of the application methods and equipment to be used;
 - Weather limitations;
 - A list of treatment solution manufacturer certified personnel to be used.
2. *Surface Preparation.* Clean all concrete surfaces to be treated before applying the penetrating water repellent treatment solution. Remove all traces of curing compound, laitance, dirt, dust, salt, oil, asphalt or other foreign materials.

Surface preparation may include the application of pretreatment cleaning agents before the use of water washing cleansing methods.

If necessary, use solvents and hand tools as required to remove bonded materials detrimental to treatment of the concrete surface.

Water washing methods of cleaning may use the addition of detergents to reduce surface tension of the cleaning water. The addition of such detergents may be used in proportions of 2% or less by weight.

During cleaning, do not damage concrete surface, remove or alter the existing concrete surface finish, or expose the coarse aggregate of the concrete. Clean in a manner to provide a uniform appearing surface color.

After cleaning with water washing methods, remove any standing water or excess moisture, which may delay surface drying or restrain surface penetration of the repellent treatment solution.

3. *Application.*
 - *Preapplication Requirements.* Allow the concrete to age a minimum of 28 days before surface treatment. Allow concrete surfaces to dry a minimum of eight hours after cleaning with water or after rain, before applying penetrating water repellent treatment solution. For formed surfaces, apply penetrating water repellent treatment after applying classes 1 through 6 concrete surface finishes, and before applying a class 7 - paint finish. Refer to Subsection 509.04(g) for definitions of surface finish classes.

Reclean previously cleaned concrete surfaces that become contaminated, before applying the penetrating water repellent treatment.

- *Inspection.* Notify the Engineer at least one day before the application of penetrating water repellent treatment so that the Engineer may inspect the work. The Engineer will use the fugitive dye in the solution to gauge the uniformity of application. Retreatment will be required in areas where coverage is inadequate.
- *Application Rate.* Use the penetrating water repellent treatment solution as supplied by the manufacturer; do not dilute or alter in any way.
Spray a flood coat of the solution onto concrete surfaces at the approved rate of coverage. Adjust the application rate as required for vertical surfaces and surfaces tined, grooved or roughened.
- *Weather Limitations.* Apply the penetrating water repellent treatment solution when the weather conditions comply with Table 515-1. Comply with the manufacturer's recommendations for weather limitations.

Table 515-1
Acceptable Weather Conditions During Application.

<u>Weather Condition</u>	<u>Acceptable Range</u>
Temperature: Air or Concrete Surface	Above 40°F (4°C) and within the manufacturer's recommended application temperature range.
Wind Speed	Below 25 mph (40 km/hr)
Precipitation	None

- *Seasonal Limitations.* Comply with the manufacturer's seasonal limitations when applicable.
 - *Traffic.* Keep traffic off treated surfaces until the applied solution has completely dried.
- (b) **Control of Materials.** Use penetrating water repellent treatment solution that is in unopened, sealed containers with the manufacturer's label identifying the product and with numbered seals intact. Each container shall be clearly marked by the manufacturer with the following information:
- Manufacturer's name and address
 - Product name
 - Date of manufacture
 - Expiration date
 - Lot identification number

Store materials delivered to the job site in original unopened containers within an appropriate storage facility. The storage facility shall provide protection from the elements and safe and secure storage of the materials.

- (c) **Sampling and Testing of Bridge Decks and Approaches.** After the treatment has been completed, the Engineer will divide the bridge deck and approach slab surface area into equal size lots for sampling, testing, and acceptance. The number of lots for a bridge will be determined by dividing the area of bridge deck and approach slabs in square feet by 20,000 ft² (2000 m²) and rounding to the nearest whole number. The minimum number of lots per bridge will be two. The area of each lot will be the area of bridge deck and approach slabs divided by the number of lots. The width of the lot shall equal the width of the deck or slab; the length will be determined by dividing lot area by lot width.

Take two core samples of treated concrete for testing from each lot of treated surface locations within the lot area selected randomly by the Engineer. The Engineer may select additional sample locations if either the coverage or water repellency of the treatment within a test area is in question. All samples taken within a lot area will be considered representative of the lot.

Before coring, find rebar in the bridge deck and approach slabs so that during coring rebar can be avoided. Make the cores 4 inches (100mm) in diameter by 4 inches (100 mm) in depth. Core the concrete in the presence of the Engineer and give the cores to the Engineer immediately after making.

Cores will be tested by the Engineer for moisture absorption and depth of treatment penetration by the requirements of Table 515-2. Bridge deck and approach slab treatment will be evaluated for acceptance and payment based on core testing results.

Table 515-2
Core Testing Requirements

<u>Test</u>	<u>Method</u>	<u>Limit</u>
Absorption	OHD L 39 (48 hour water immersion)	1% maximum by weight
Penetration	OHD L 40	0.15 inch (3.8 mm) minimum depth

The Contractor may independently test the surface treatment to determine the adequacy of the work. A maximum of one core per lot will be permitted for this purpose. The Contractor's results will not be used for acceptance or payment.

- (d) **Acceptance.**
1. *Concrete Surfaces Other Than Bridge Deck and Approach Slabs.* Acceptance of penetrating sealer application for concrete surfaces other than bridge decks and approach slabs shall be based upon two inspections by the Engineer. The Engineer will visually examine the treatment surfaces after cleaning and, again, after treatment. If all treatment surface areas have been properly cleaned according to these specifications, and by visual inspection of the fugitive dye, the penetrant sealer has been adequately applied within the approved rates of application, the work will be accepted.

2. *Bridge Decks and Approach Slab Surfaces.* Acceptance of bridge deck and approach slab treatment will be based upon the absorption and penetration test results for each lot. Payment will be adjusted by the pay factors for absorption and penetration.

The pay factor for absorption shall be determined by the following equations:

$$\begin{array}{ll} PF_a = 1.00 & \text{for } A \text{ of } 1.000 \text{ or less,} \\ PF_a = 1.00 - (A - 1.0) & \text{for } A \text{ between } 1.000 \text{ and } 1.500, \\ PF_a = 0.00 & \text{for } A \text{ of } 1.500 \text{ or more,} \end{array}$$

where:

PF_a is the pay factor for absorption,
A is the percentage of absorption from OHD L39 test.

The pay factor for penetration shall be determined by the following equations:

$$\begin{array}{ll} PF_p = 1.05 & \text{for } D \text{ of } 0.25 \text{ (6.3 mm) or more,} \\ PF_p = 1.00 + 0.05(D - 0.15)/0.1 & \text{for } D \text{ between } 0.15 \text{ and } 0.25, \\ (PF_p = 1.00 + 0.05(D - 3.8)/2.5) & \text{(for } D \text{ between } 3.8 \text{ and } 6.3 \text{ mm)} \\ PF_p = (D - 0.05)/0.1 & \text{for } D \text{ between } 0.05 \text{ and } 0.15, \\ (PF_p = (D - 1.3)/2.5) & \text{(for } D \text{ between } 1.3 \text{ and } 3.8 \text{ mm)} \\ PF_p = 0.00 & \text{for } D \text{ of } 0.05 \text{ (1.3 mm) or less} \end{array}$$

where:

PF_p is the pay factor for penetration,
D is the depth in inches (mm) of penetration from OHD L40 test.

The overall pay factor for each lot shall be:

$$PF = PF_a \times PF_p$$

where:

PF is the overall pay factor.

Payment for a lot will be determined by multiplying the Contract Unit Price by the overall pay factor, PF, for that lot. If a pay factor for any lot on a structure is less than 1.00, then the incentive portion (that in excess of 1.00) of the overall pay factors for all lots on the structure will be reduced by 50 percent.

- (e) **Core Hole Repair.** Repair core holes with a cement mortar consisting of Portland Cement, concrete sand, water and acrylic polymer binder. Proportion the cement mortar as recommended by the manufacturer of the acrylic polymer binder. Submit mix design for approval. Place mortar the same day the cores are taken. Treat the patch surface with treatment solution after curing.

515.05. METHOD OF MEASUREMENT.

The penetrating *water repellent* treatment will be measured by the square yard (square meter) of treated concrete surface area.

515.06. BASIS OF PAYMENT.

Accepted quantities of penetrating water repellent treatment of concrete surfaces other than bridge decks and approach slabs, accepted according to Subsection 515.04(d)1, will be paid for at the contract unit price for:

(A) **WATER REPELLENT (VISUALLY INSPECTED)....SQUARE YARD (SQUARE METER)**

Accepted quantities of penetrating water repellent treatment of bridge decks and approach slabs, accepted for payment according to Subsection 515.04(d)2, will be paid for at the adjusted contract unit price for:

(B) **WATER REPELLENT (PERFORMANCE TESTED).SQUARE YARD (SQUARE METER)**

Payment for the above pay items shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

SECTION 516

DRILLED SHAFT FOUNDATIONS

516.01. DESCRIPTION.

This work consists of constructing drilled shafts including the furnishing and placing of reinforcing steel and concrete, all in accordance with the contract documents.

516.02. MATERIALS.

- (a) **General.** Materials shall conform to the requirements specified herein and the following sections:

Structural Concrete	509
Reinforcing Steel for Structures	511

- (b) **Concrete.** Furnish Class AA concrete modified as follows. Limit the maximum nominal aggregate size to 3/4 inch (19mm) . Increase minimum cement content 10% for concrete placed under water or slurry.

Adjust approved admixtures for site conditions to ensure that the concrete has at least 6 inches (150 mm) of slump at the start of placement and at least 4 inches (100mm) of slump at the completion of placement and casing/reinforcement alignment. Maintain the concrete temperature under 85°F (30°C) during placement.

- (c) **Casings.** For all exterior casings, use smooth, clean, watertight, steel casings of ample strength to withstand handling and driving stresses, and the concrete and surrounding earth pressures. The dimensions of a permanent casing is subject to American Pipe Institute tolerances applicable to regular steel pipe. If only a single casing is used in a shaft, the casing is considered an exterior casing.